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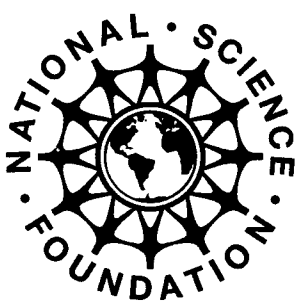
ABSTRACT

The Local Systemic Change through Teacher Enhancement Initiatives carry forward the systemic reform efforts of the Directorate for Education and Human Resources and the goals of the Teacher Enhancement (TE) Program in the Division of Elementary, Secondary, and Informal Education at the National Science Foundation (NSF). The TE Program supports professional development that leads to a new level of teacher competence within a supportive school culture. This enables teachers to engage all students from pre-kindergarten through Grade 12 in rich and challenging programs in science, mathematics and technology. Supported projects seek to improve the disciplinary and pedagogical knowledge of teachers. They also involve administrators and others who play significant roles in providing quality science, mathematics, and technology education for students. This directory focuses on a subset of TE projects that engage entire school districts in the reform of science, mathematics, and technology education. Systemic change projects are characterized by a shift in the focus from the professional development of the individual teacher to the professional development of all teachers within the whole school organization; a vision of what the K-12 science/mathematics/technology (SMT) program should be; and a plan for the implementation of exemplary, standards-based instructional materials. This should lead to the creation of professional communities where teachers are empowered to bring about change and encouraged to reflect on their own teaching and learning. This directory summarizes 47 projects in 23 states across the United States. (Author/DKM)

Local Systemic Change Project Directory



National Science Foundation

Directorate for Education and Human Resources

Division of Elementary, Secondary, and Informal Education

Teacher Enhancement Program

1997

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Introduction

The Local Systemic Change through Teacher Enhancement Initiatives carry forward the systemic reform efforts of the Directorate for Education and Human Resources and the goals of the Teacher Enhancement (TE) Program in the Division of Elementary, Secondary, and Informal Education. The TE Program supports professional development that leads to a new level of teacher competence within a supportive school culture. This enables teachers to engage all students from pre-kindergarten through grade 12 [preK-12] in rich and challenging programs in science, mathematics and technology. Supported projects seek to improve the disciplinary and pedagogical knowledge of teachers. They also involve administrators and others who play significant roles in providing quality science, mathematics, and technology education for students.

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The NSF supports two types of Local Systemic Change (LSC) projects: Science, Mathematics and Technology, grades K-8; and Mathematics, Grades 7-12. The 47 Local Systemic Change projects provide over 47,000 teachers with professional development and are spread across every geographic region in the nation. While designed and operated locally, they will reach over *1.6 million* students in 240 school districts nationally. All participating districts base their projects on a self-assessment of their current SMT programs, with a focus on their strengths and needs. The districts also develop partnerships among stakeholders, such as parent groups, colleges and universities, and businesses.

Hands-On Activity Science Program

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The Local Systemic Change Through Teacher Enhancement project is the result of a collaboration between five Alabama school districts and the University of Alabama, Huntsville (UAH). The collaboration of school districts includes Athens, Decatur, Fort Payne, Morgan County, and Scottsboro, Alabama. The project combines resources from the school districts, UAH and local engineers and scientists to support a hands-on, activity-inquiry, module-based science curriculum. The curriculum to be implemented includes NSF-supported *Science and Technology for Children* (STC), *Full Option Science System* (FOSS), and EDC's *INSIGHTS* materials as instructional modules. The new science program offers equitable opportunities to all students, incorporates principles of the new State Course of Study of Science, and is aligned with national content, teaching and assessment standards. The five school districts, in collaboration with the university, also support a Materials Resource Center that supplies and refurbishes materials for teachers and provides professional development for teachers and principals.

During this five-year project, 518 teachers receive 100 hours of professional development and 102 selected lead teachers receive 230-400 hours of enhancement. This extensive training builds local capability for continued improvement after the project expires. The summer program focuses on the enhancement of the lead teachers. They analyze progress made during the past year, plan follow-up activities and prepare new workshops for teachers and principals in the upcoming school year. They provide leadership to the teachers in their schools for implementing change. Three of these lead teachers are chosen to become part of the full-time project staff so that they can conduct workshops, visit schools to assist in on-site enhancement, and guide district and cross-district teacher enhancement sessions. The role of the lead teacher-principal teams is to inform parents about the project and gather their support.

Impact: 5 districts; 37 schools; 620 teachers; 13,583 students.
NSF Support: $1,935,000; ***Cost-Share:*** $2,179,137.

Earth Systems Implementation Project (ESIP)

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The *Earth Systems Implementation Project (ESIP)* builds on the Anchorage School District's (ASD) award winning hands-on elementary science program. Administrators, over 2,000 parents, and community members from major Alaskan science professions are working with project staff to implement *ESIP* in all ASD's 61 elementary science classrooms. This inquiry-based science curriculum utilizes modules from nationally validated and NSF-supported instructional materials including *Science and Technology for Children (STC), EDC-Insights*, and *FOSS*. The underlying purpose of the curriculum is to capture, develop and nurture the essence of a good scientist in all students. Project Staff and teachers are developing a student assessment tool called "The Citizen's Guide to Earth Systems". Alaska Science and Technology Foundation and ARCO Alaska and British Petroleum, two major industry partners and at least eight state and federal agencies are collaborating their efforts to support this project.

A unique aspect of this project is the yearly curriculum plan for the participating schools. Ordinarily, each teacher is expected to complete three curriculum kits throughout the school year but due to the high expertise of the teachers, a fourth curriculum unit is being included. The teacher can choose a subject that is either environmentally specific to Alaska, an experimental subject or a technological subject. This offers the teachers an opportunity to enhance their learning of teaching science and broaden the scientific knowledge of their students. The fourth strand may also include Community Action Projects through which students apply what they have learned to their own neighborhoods and/or larger community.

Professional development opportunities for all teachers include enhanced training in both content and pedagogy. Secondary teachers, university faculty and community scientists are being partnered with the teachers during training. Training is available for school administrators, parents and other community members as an effort to expand the support base for elementary science education reform.

This project is designed for two tiers of teaching: Science Support Teachers and all elementary teachers at their respective grade levels. The first tier of training creates 366 Science Support Teachers so at the end of the three years, every elementary school has six Science Support Teachers, almost one for each grade level. They receive a ten-day course of training for three summers and all kits within the curriculum. The training includes content, field experiences, application of content, and team building strategies. The second tier involves training for all ASD elementary teachers. All teachers are trained in collegial groups of 20. Each group includes at least one Partner Scientist and/or university teacher in life, earth or physical science and an ASD secondary teacher with a discipline specialty.

At the conclusion of the 4.5 years, *ESIP* will be effectively implemented in Alaska's largest school district. The Anchorage School District enrolls approximately 47,000 or 38 percent of the state's public school children. Of the 47,000, 28,000 of them are in grades K-6. Anchorage families present a wide socio-economic profile and the school district is highly multicultural: over 100 languages are spoken within its student population, where a significant portion is Native Americans.

Impact: 1 district; 61 schools; 1,050 teachers; 28,000 students.
NSF Support: $3,085,164; ***Cost-Share:*** $2,128,700.

Changing the High School System: Implementing the Interactive Mathematics Program in Arizona (AZ IMP2)

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AZ IMP2 is a 5-year Local Systemic Change project for 187 mathematics teachers in grades 9-12 in five Arizona school districts and schools in the Utah, Colorado, Arizona, New Mexico (UCAN) *Rural Systemic Initiative*. Fifty-two teachers in feeder middle schools in these areas are also targetted. This project is a collaborative effort between the unified school districts of Chandler, Sunnyside, Santa Cruz, Mingus and Sedona-Oak Creek; Maricopa County Community College; Arizona State University and the Intel Corporation to implement the NSF-supported *Interactive Mathematics Program (IMP)* in the districts.

Arizona's high school enrollment is 40% minority (i.e., Hispanic, African American, Asian American and Native American) with significant numbers of these students scoring well below the national and state scores. Since the current mathematical educational system is not working for all students, this project is instituting complete systemic change, starting with the teachers.

Teachers participate in summer professional development workshops for each of the four years of the *IMP* curriculum led by teachers and university staff who are experienced in the curriculum. Teachers develop leadership skills to provide participating districts with an internal capacity for professional development. Middle school teachers from participating districts will receive professional development to help them better prepare students to enter the *IMP* classes. Teachers from schools considering the adoption of the *IMP* materials will take part in the professional development activities so that a more informed decision can be made. Follow-up support and learning activities occur during the school year.

School teams of administrators, counselors and teachers of other subjects are formed and receive professional development to enable them to better support the mathematics teachers implementing *IMP*. Personnel from the three state universities will take part in the professional development activities. Additional school districts will join the project in years three and four.

Impact: 5 district(s); 9 school(s); 239 teachers; 30,000 students.
NSF Support: $1,071,457; ***Cost-Share:*** $2,614,394.

Mesa Systemic Initiative

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In collaboration with Arizona State University, the Mesa School District is providing systemic reform for all teachers in grades K-8. The Mesa School District has twenty years' experience of providing teachers with professional hands-on science and mathematics development. Special emphasis is being placed upon four critical areas: 1) new teacher support; 2) cross-district leadership development; 3) moving beyond mechanical use of curriculum; and 4) supporting diversity and equity in special populations.

As one of the fastest growing cities in the country, it is projected that the number of teachers will increase to accommodate the growing student population. This initiative is preparing for this constant growth of teachers by providing leadership development and teacher training. As the population grows, a growing number of the students are from minority and lower income families. This project realizes the need for additional professional development of administrators and teachers to effectively serve this diverse student body. The project is moving towards the creation of true learning communities at each school site.

The primary focus of the Mesa Systemic Initiative is to move teachers along a continuum of growth in using hands-on curriculum. The technology for teacher enhancement includes the integration of software application and computer-assisted instruction in the curriculum, distance learning, telecommunications and video technology. The training includes cross-district leadership development and instructional opportunities in content and pedagogy. Most of the teachers are expected to exceed the minimum 100-hour professional development requirement.

The curriculum units are designed for grades K-6 with three units at each grade level designated as "core" science units required to be taught by every teacher. Additional units integrating social studies, health and foreign language are also required at specific grade levels. The majority of this curriculum reflects the changing needs and abilities of Mesa teachers. The current curriculum centers around the utilization of thematic units that are supported by print materials, laser discs, CD-ROM discs and more importantly a wide variety of science materials. The overall outcome for learning at this level is to foster the continued development of the concept of "lifelong learners." The district mathematics curriculum reflects the NCTM standards by utilizing alternative strategies, such as, manipulatives, calculators and cooperative learning.

The primary responsibility of Arizona State University is to lead in the design and development of the content components in the professional development of teachers. As a result of this project, a redesign of the pre-service programs for teachers at ASU is underway. ASU is also responsible for increasing the number of preservice teachers and the amount of involvement time preservice teachers spends in Mesa classrooms. Finally, they develop special graduate programs and mentoring support for current teachers who need to become certified in the areas of mathematics and science.

This systemic initiative is unique in that it recognizes that a traditional "one-size-fits-all" staff training approach is not the most effective way of enhancing teacher development. Instead, the Mesa School District realizes that teachers are naturally at different levels of professional development and therefore need different tools and resources.

Impact: 1 district; 58 schools; 2,000 teachers.
NSF Support: $5,999,991; ***Cost-Share:*** $5,283,645.

Teachers as Agents of Systemic Change (TAASC)

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The Center for Education and Equity in Mathematics, Science, and Technology at California State Polytechnic University is working with four multicultural school districts in eastern Los Angeles County to implement systemic change in the secondary mathematics programs. The four districts have 20 middle schools and 12 high schools serving 69,600 students, of whom 66% are Hispanic.

This five-year project empowers teachers, in cooperation with their administrators, to align the mathematics curriculum, instruction, and assessment with the NCTM Standards. The districts are striving to improve student performance while increasing the number of traditionally underrepresented students, particularly minority and female, who take mathematics courses.

The professional development workshops provide teachers with additional content knowledge, a renewal of pedagogical skills, and, in some instances, skills to help the teacher-leaders successfully implement the mathematics curriculum. Teachers receive more than 200 hours of staff development using nationally validated instructional materials, such as the NSF funded *Harvard Project Calculus*, *Connected Mathematics*, *Core-Plus*, *STEM,* and *SIMMS*. The teacher-leaders provide most of the staff development through summer institutes, all-day inservices and after-school meetings. The institutes focus on improving content, adapting methodologies and strategies, using multiple technologies, and building on the diversity of a multicultural and gender-equitable classroom. Teachers and teacher-leaders on-going classroom support is provided by a project coordinator. Teachers are forming networks and partnerships among themselves, administrators, professional societies, and parents. Parents and the community are involved through Family Mathematics Nights.

Impact: 4 district(s); 32 school(s); 258 teachers; 69,600 students.
NSF Support: $1,142,879; ***Cost-Share:*** $835,485.

The Systemic Change in Mathematics Project

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This Local Systemic Change project involves all K-5 teachers and all 6-9 mathematics teachers in the Santa Ana Unified School District (SAUSD) over a five year period. All teachers, instructional assistants and administrators are participating in two years of staff development in mathematics content and pedagogy with an emphasis on newly adopted instructional materials and reform. All together, there are 2,100 participants.

The Santa Ana Unified School District is located 40 miles south of Los Angeles. It is the largest school district in Orange County and the 8th largest in the state. The district has 45 schools, 30 of which are K-5 therefore serving 48,900 students. It is the fastest growing district in the county and is located in an urban area that is generally not affluent. Sixty-seven percent of the students have Limited English Proficiency (LEP), the second largest number of LEP students statewide. At the elementary level, 81 percent of the students are enrolled in the Free/Reduced Lunch Program. SAUSD serves a 94 percent minority population in a county whose average is 20 percent. The diverse population poses enormous challenges to the district academically, socially and culturally. A major objective of this project is reaching out to the underrepresented population of Hispanics and other minorities who choose not to pursue an academic career in mathematics and science.

This project is built on two successful models previously funded by NSF: *Santa Ana - Fullerton Elementary Mathematics Project (SAFEMAP)* and the *Language and Mathematics Project (LAMP)* and a third district project, *Secondary SAFEMAP (S^2)*. This project differs from the previous projects in that it is not voluntary. Every K-5 teacher and all 6-9 mathematics teachers are required to participate. This systemic change project provides a model for restructuring a district's K-9 mathematics program by involving teachers, administrators, parents and the community. The project is incorporating the current California Mathematics Framework (1992) and National Council of Teachers of Mathematics Curriculum and Evaluation Standards as models for the professional development of the Santa Ana Unified School District.

The goals of the project are as follows: 1) change the classroom behavior of teachers and students as they do mathematics; 2) change teachers' attitudes towards teaching mathematics; 3) encourage parents, business and community involvement; and 4) change teachers' expectations of mathematical achievement for minority students, including LEP students, to reflect the philosophy that all students can do mathematics.

On-going support of this program includes implementation of site-based Action Plans focusing on teacher discourse, reflection, and classroom observation and coaching resulting in an additional 100 hours of professional development. Parents, community and business partners participate in the project by learning about education reform and by assisting in site-based events and activities resulting in another 100 hours of participation. The District also provides two staff development days per year devoted to mathematics involving all teachers, instructional assistants and administrators.

Impact: 1 district; 37 schools; 1,620 teachers.
NSF Support: $5,972,910; ***Cost-Share:*** $15,809,754.

Teacher Enhancement for Student Success (TESS)

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Teacher Enhancement for Student Success (TESS) is a five-year project, closely coordinated with the *Fresno Urban Systemic Initiative,* which provides 120 hours minimum of teacher enhancement for the 2040 K-8 teachers of mathematics and science in the Fresno Unified School District and is supported by a literacy campaign. Fresno is one of the fastest growing cities in California and is known for its cultural and linguistic diversity. The District receives approximately 2,000 new student per year, many of them immigrants. One-half of the students have been identified as living in poverty and 60 percent receive free or reduced lunches. There have been 89 different primary languages or dialects identified with one-third of the students showing Limited English Proficiency. While diversity offers unique opportunities, it also creates challenges for students and teachers. *TESS* focuses on developing leadership capacity, institutionalizing intensive teacher enhancement strategies, reforming curriculum, strengthening instructional practices, changing the role of the teacher and empowering students and teachers with technological capacity.

The District developed the Professional Development and Technology Center that uses a support team of mentor teachers, Teachers on Special Assignment (TSA), site leaders, and university specialists to train teachers and provide services to the schools. The support team trains teachers in content and exemplary programs, and in working with diverse student populations. The training also focuses on activity-based lessons integrated with real world applications that involve using the relevant technology available today. Principals and administrators receive hands-on training in instructional strategies in mathematics and science. The program focuses on curriculum and instructional materials on the California adoption list with enhancement being done in conjunction with the *California Renaissance project (SSI)* and teams involving the California Mathematics Project and California Science Project. Schools will be involved as units of enhancement with no school starting mathematics and science at the same time.

Impact: 1 district; 79 schools; 2,040 teachers.
NSF Support: $5,807,047; ***Cost-Share:*** $31,705,834.

Leadership Institute for Teaching Elementary Science (LITES)

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This five-year project seeks to systematically address the serious problems in the curriculum of the Oakland Unified School District by creating conditions that support teacher-led, school-based reform that results in science becoming prioritized in the curriculum.

Oakland is the sixth largest urban district in California. In the 1990 U.S. Census, Oakland was identified as having the most diverse population of any metropolitan city in the U. S. -- at least 82 languages and ethnic groups are represented: 56% Black, 18% Asian/Pacific Islander, 16% Hispanic, 8% White, 1% Filipino and 1% Native American. Traditionally students, particularly females, Blacks, Hispanics and Native Americans have not succeeded in mathematics or science. Academically, Oakland's students consistently rank in the lowest quartile in the State in reading, mathematics and science. Twenty-six percent of the students are identified with Limited English Proficiency and 48% of the students come from families qualifying for Aid to Families with Dependent Children. The diverse ethnic and socioeconomic population poses an additional challenge to the school system and its efforts to reform the curriculum but it also insures that *LITES* teachers have the potential for reaching significant numbers of "at risk" youth.

The *LITES* project targets all elementary teachers located in the 60 schools of the Oakland School District and eventually will impact the entire K-12 student population.. A broad-based coalition of scientists and family educators from colleges, industry schools, community, and science center are involved in the *LITES* effort.

Teachers participate in a research-based *LITES* curriculum for 5 weeks each year for two years. They in turn train a school-site cluster for five same grade level colleagues. Key features of the LITES curriculum are 1) a linkage of four informal science centers to teach a 4-day thematic science course on ecosystems in environments that teachers can use year round as living laboratories for their own learning and classroom teaching; 2) a technology course taught in an industry setting where teachers can learn first hand the complex concepts in this often misunderstood discipline; and 3) an integration of pedagogy and science subject matter courses combined with practical classroom experience. The Leader Teachers are assisted in their task by a team of 29 *LITES* staff who provide school site support and by 72 *LITES* pilot program teachers who serve as consultants.

There are two major components to the LITES curriculum training. The first is that elementary teachers learn science content, not in formal classrooms, but in science-rich environments - an insectarium, zoo, botanical garden and a marine educational/research center. The second component is a series of five courses covering biology, chemistry, mathematics, physics and integrated science. The central concept of the *LITES* curriculum is pedagogy and the structure is based on the California Science Framework and the teacher-developed Oakland Science Scope and Sequence Document. It is organized into three major areas: Life, Physical, and Earth Sciences and also include six themes: evolution, patterns of change, scale and structure, energy stability and systems and interactions.

The project is supported by a collaboration consisting of the Oakland Unified School District, the city of Oakland and the East Bay Regional Parks. There is also a commitment from principals and school administrators, parents and the local community to support educational reform in their school district.

Impact: 1 district; 60 schools; 1,050 teachers; 52,000 students.
NSF Support: $3,941,940; ***Cost-Share:*** $1,634,428.

Bay Area Schools for Excellence in Education

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The Bay Area Schools for Excellence in Education (BASEE) is a partnership between Hewlett-Packard Company and eight school districts in California's Silicon Valley (Cupertino Union School District, Los Altos School District, Menlo Park School District, Mountain View School District, Palo Alto Unified School District, Redwood City School District, Santa Clara Unified School District and Whisman School Districts). Together the districts include 74 elementary schools, over 1900 teachers and 44,000 students in a geographic region that includes much of the Mid-Peninsula region of the San Francisco Bay Area. The districts began working together in 1992 to launch district-wide kit-based hands-on elementary science programs.

The BASEE collaborative offers science training to teachers via three different strands. Strand I introduces teachers to the science kits and is designed for new teachers and those new to the curriculum; Strand II provides ongoing professional development for teachers ready to focus on content background connected with effective teaching strategies. Strand III provides leadership opportunity for those wishing to solidify their science background while sharing their expertise at school sites. There is a separate strand for administrators that supports their supervision of science teaching and helps them create a vision for science in their schools.

The collaborative has created a variety of offerings to meet the various time needs of teachers. There are summer institutes, evening programs during the school year, grade level meetings and district staff development days. Prior to attending these sessions, each teacher has the opportunity to assess his/her own needs in the area of science with connections to math and technology. BASEE programs meet some of those needs, while others are funded with dollars directed to the schools for site decision-making.

Substantial in-kind support from HP and the participating districts augments the NSF grant. Additional monetary support has been pledged over the five-year period from three local foundations: the William and Flora Hewlett Foundation, the David and Lucile Packard Foundation and the Noyce Foundation. The partnership also draws on the rich resource of scientists, engineers and other volunteers from the local community, HP employees and others, such as members of the local chapter of American Women in Science.

Impact: 8 districts; 74 schools; 1,900 teachers; 44,000 students.
NSF Support: $5,683,364; ***Cost-Share:*** $1,427,740.

Mathematics Renaissance K-12

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This Local Systemic Change in Mathematics (LSCM) project builds on and joins the Middle Grades Mathematics Renaissance and the California Mathematics Project to provide teacher enhancement for 2,000 K-12 teachers of mathematics. Elementary and secondary mathematics teachers receive a minimum of 100 and 130 hours, respectively, of professional development over the life of the project. The teachers are in 16 clusters in four regions of California. The cluster, defined by a high school and its feeder middle and elementary schools, is the unit of participation in the project. Algebra -- algebra for all, algebraic thinking throughout the K-12 curriculum -- is the center of the mathematical work. The project also provides the teachers with the knowledge base to implement comprehensive materials, develops a model for K-12 articulation, and informs educators on the process of articulating a coherent K-12 program of professional development and instruction. During this project, linkages are forged among schools engaged in mathematics reform, the California Mathematics Project (CMP) sites, and university mathematicians.

Districts are allowed to choose from a list of high quality instructional materials, both NSF-supported and others, from which to make their adoption decisions. As districts make their decisions, the project assists teachers in classroom implementation of the materials.

Impact: 16 districts; 110 schools; 2,000 teachers; 52,000 students.
NSF Support: $5,143,393; ***Cost-Share:*** $3,864,261.

CITY SCIENCE - University of California, San Francisco
Institute for Elementary Teachers

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This is a Local Systemic Initiative project that builds on a past leadership effort in San Francisco to improve the teaching of science and mathematics. The Science and Health Education Partnership (SEP) of the University of California, San Francisco (UCSF), in partnership with the San Francisco Unified School District (SFUSD), is working together to enable all of the city's elementary schools to accomplish effective, site-based science and mathematics education reform by forming a teacher professional development effort that supports the implementation of inquiry based hands-on instructional units. This partnership involves many scientists and has resulted in the development of 100 lead teachers for the district. This project is also building on a collaborative effort with the San Francisco Exploratorium to ensure the creation of major leaders in science education. The Lawrence Hall of Science's *Full Option Science System* (FOSS) and Educational Development Center's *INSIGHTS* are the instructional materials used in the curriculum kits. Mathematics, reading and writing are three areas that are implemented as a part of the science program where appropriate.

San Francisco's school district has a population of approximately 1300 elementary teachers, including classroom and resource teachers. For this project, the teacher participants are broken down into four groups: 1) science systemic teachers who are previous participants in the City Science program; 2) beginning teachers who have less than 2 years full-time teaching; 3) focus school teams made up of 3-4 teachers per year at eight selected Focus Schools; and 4) the remainder of the teachers in the District.

UCSF's City Science program provides an intensive hands-on science project for 400 SFUSD teachers who have taught less than seven years and a less intensive program for 600 more experienced teachers in order to broaden the base of teachers with hands-on science in a cooperative learning environment. It also provides new opportunities for a subset of the 100 teachers who are current City Science participants to expand their capacity as science teachers while serving to further develop in their role as leaders. They support specific aspects of the district-wide science education reform and mentor new leadership that sustains the reform process in their schools.

During the last three years, additional teachers from each Focus school are asked to join the Leadership Team for at least one year of the Summer Institute to further enhance their expertise. They also participate in monthly follow up sessions during the subsequent school year. Groups of 3-4 teachers from each Focus School are added at the beginning of each Summer Institute until all of the teachers at each school have enrolled in the project. The teachers receive additional training through release time to allow for participation in site planning, school-wide science events for students and parents.

This project provides an opportunity to address the challenge of teacher attrition and expansion in the District by offering the two-year sequence of basic City Science Summer Institutes for beginning teachers. It also provides development and training tailored for more experienced teachers to enhance their confidence and teaching in hands-on, inquiry based science education.

Impact: 1 district; 76 schools; 1,300 teachers.
NSF Support: $3,873,451; ***Cost-Share:*** $1,667,517.

National School District Systemic Teacher Enhancement Project (NSSTE)

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This project is the result of a collaboration between the National City School District, the University of California, San Diego (UCSD), the National City government, local businesses, industry and the community. It closely aligns with the NSF funded California *State Systemic Initiative -- California Advocacy for Mathematics and Science (CAMS)*, the California State Science Framework and the national science standards. This project intends to enhance the science and technology backgrounds of the entire K-6 instructional staff of the district over four years.

National School District is located in National City, California just south of the city of San Diego and ten miles north of the Mexican border. With a population of 56,000, National City comprises ten square miles of low-income housing, attracting new immigrants from Mexico as well as military families. It is the thirteenth poorest city by per capita income in the United States with a median income of $14,000 and 52 percent of the school district's families are headed by a single parent. The National City School District serves an ethnically diverse and poor student population. The population of students consists of 0.6 percent Alaskan/American Indian; 1.7% Asian, 13.7% Filipino, 5.7% African American, 8% white, 69.1% Hispanic and 1.1% Pacific Islander. Forty percent have Limited English Proficiency; 55% have Chapter 1 eligibility; and 75% of newly enrolled students come from Mexico.

This project combines the resources of the school district, UCSD, private industry, and the community to institute and support an integrated, inquiry-based, hands-on science curriculum in all National City elementary schools. The curriculum to be implemented includes NSF funded *FOSS* and the State of California's *Child's Place in the Environment* as instructional modules for grades K-6. In addition, all students take an active part in the activities at the Stein Farm, a farm purchased for the students and community members by the city. A two week Summer Computer Camp is offered to upper grade students in addition to grade level and special education summer science enrichment classes available to all students.

Major goals have been set forth to tackle the social, cultural and academic challenges currently faced by the National City School District. There is a serious achievement gap in mathematics and science among the historically underserved students in the National School District. Hispanics and African Americans score at much lower levels on all measures of achievement. This project plans to: 1) implement an inquiry oriented, activity based science curriculum; 2) upgrade the science content background and leadership skills; and 3) initiate systemic reform.

Each year 60 lead teachers attend a four-week inservice program. The program is held in conjunction with a district wide summer enrichment program that incorporates a practicum for the participants. University scientists, science educators, and master teachers from the district staff the summer leadership institute. Parent and community members assist in both managing and maintaining the instructional materials.

This cadre of 60 lead teachers form a science leadership team at each school site to oversee continuing science education reform. They provide full day staff development programs, weekly school year selected inservice programs and act a peer coaches and resources to the school site. Staff and parent volunteers attend six Saturday academic year sessions and receive university extension credit from UCSD for their participation.

Impact: 1 district; 10 schools; 410 teachers; 6,639 students.
NSF Support: $1,251,763; ***Cost-Share:*** $383,166.

Partnerships for Systemic Reform to Improve Mathematics Education

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This is a 4-year Local Systemic Change project to enhance 750 K-8 teachers in 35 schools from Oxnard and Ventura, California school districts. The project has six goals: teachers gain mathematical content knowledge and pedagogical and assessment skills; teachers and administrators increase their understanding of equity issues so they can change policies and practice; teachers learn how to form partnerships with parents; and administrators deepen their understanding of the reform so they support the teachers as they implement these changes.

The enhancement is focused on California Framework-based mathematics and instruction. Districts will adopt comprehensive Framework-focused instructional materials based on pilot use of materials prior to the adoption. Elementary school teachers receive 22 days (132 hours) of enhancement over the 4 years of the project through summer and academic year workshops. Middle school teachers receive 12 days of enhancement since they are building on current work in the Mathematics Renaissance project, *California State Systemic Initiative*.

School/family partnerships is also a thrust of this effort with teachers conducting programs with parents in their own schools. Helping teachers improve the understanding of and interest in mathematics of students from underrepresented groups is an important component. Site and district administrators meet in sessions each year of the project to learn what it takes for successful implementation of this project at their sites and across the district.

Impact: 2 districts; 35 schools; 750 teachers; 22,500 students.
NSF Support: $2,238,970; ***Cost-Share:*** $823,110.

Language Acquisition in Science Education for Rural Schools (LASERS)

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Teachers in rural central California face the challenge of providing quality science education to a rapidly increasing number of language minority students. A regional consortium that includes the University of California, Santa Cruz, Life Lab science program and seven school districts have joined together to fulfill this challenge. The *LASERS* project is (1) implementing systemic change in a science education program that is responsive to the cultural, linguistic, and individual variations among elementary school students; (2) involving schools and the community in a process of systemic educational change; and (3) developing a national model of bilingual science education.

The focus of implementation is on students, teachers, administrators and communities in 50 elementary schools in a rural tri-county area where 66% of the students are Hispanic, 48% of the students are limited English speakers, and 33% of the students are children of migrant agricultural workers. The seven school districts are located in three of the most productive agricultural regions in the world: the Salinas Valley, Pajaro Valley, and Hollister/San Juan.

The project is based on the constructivist principle that science teaching should build on and challenge students' preconceptions and provide experiences that allow them to construct their understanding in a context that is meaningful to them. The goal of *LASERS* is to make links between school science and the scientific conceptions children have developed in their homes, community, and local ecology. The Life Lab science curriculum, used in the project, teaches physical, earth, and life science through a garden laboratory. This curriculum engages students with the language and process of scientific inquiry in a context that is relevant and comfortable to them. The families of most of these students work in agriculture-related jobs and all have grown up surrounded by fields of fruit and vegetables.

This project is taking a new approach to school improvement by focusing on the total institutional and community system which influences the teaching and learning process. The program involves the whole community--students, teachers, administrators, university researchers, parents, business, and community members--in the process of educational change. *LASERS* is establishing a rural regional consortium to pool resources among multiple districts; develop school plans that integrate district, state, and national goals; develop a team of teacher leaders who mentor all participating teachers at their school sites; and involve parents and community members in developing school plans, volunteering in the classroom, and in building connections to the home. The *LASERS* researchers will develop a model for bilingual science education and the systemic change process.

Impact: 7 districts; 50 schools; 1,272 teachers; 30,000 students.
NSF Support: $4,420,831; ***Cost-Share:*** $3,980,952.

A Systemic Partnership to Improve the Teaching and Learning of Science for All Children

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This Local Systemic Change project is submitted by a Coalition of nine Delaware School Districts, the State Department of Public Instruction and the Delaware Science, Math and Technology Education Foundation. Support and expertise is drawn from the State Legislature, the school districts, business, industry, and academia. The project initiates a hands-on science program in all 58 elementary schools in the 9 school districts. Approximately 1,800 elementary teachers in the program receive professional development in order to help them fully implement exemplary curricula – NSF-supported *FOSS, Insights and Science and Technology for Children*. This program will:

- Provide every elementary teacher with 150 hours of professional development linked to exemplary curricula in order to deepen their understanding of science content, strengthen their capacity to teach science and embed science as a central element in the K-6 curriculum.;
- Build the capacity to sustain science education in every district by developing a network of teacher leaders in every school in the Coalition and creating a core of district Science Specialists throughout the state to support the Lead Teachers.; and
- Foster partnerships with higher education to align pre-service and in-service teacher education.

Impact: 9 districts; 58 schools; 1,802 teachers; 46,125 students.
NSF Support: $5,402,013; ***Cost-Share:*** $4,900,000.

Teacher Enhancement Through A Elementary Science Education Partners (ESEP)

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This project promotes science and mathematics reform for K-5 level teachers in the Atlanta Public Schools by providing teachers with college undergraduate science majors as "science partners". The science partners register for a two-credit course or a service learning program, receive training in inquiry-science instruction, and spend 5-6 hours every week in the classroom team-teaching science lessons with the assigned teacher. The project is guided by the conviction that all children can learn science and that they gain new scientific knowledge most readily by being actively engaged with real materials and equipment. Children should be encouraged to ask questions and do meaningful experiments as well as read books and learn scientific vocabulary.

The main objectives of the project are to provide materials and help K-5 teachers use inquiry-based instructional techniques that promote problem-solving skills and show that science can be relevant to children's daily activities. Another important aspect of this project is the staff's belief that science instruction must be integrated with mathematics, language arts and other subjects. The Atlanta Public Schools, which includes 1,600 K-5 teachers in 72 urban schools, serves a population over 30,000 children. Ninety one percent of the student body are African American and 76 percent qualify for free or reduced-price lunch.

Science partners and faculty science mentors are recruited from Emory and seven collaborating institutions: Georgia State University, Morehouse School of Medicine, Georgia Institute of Technology, Clark-Atlanta University, Morehouse College, Morris Brown College, and Spelman College. In addition to providing science partners and mentors, the project has five other major components. 1) preparation and distribution of a modular science kit-based curriculum; 2) a multi-level staff development effort; 3) a strong focus on integrating performance-based assessment with pedagogy as well as formative and summative assessments designed to allow ongoing evaluation of all aspects of the program; 4) induction and training of *ESEP* participants into an electronic network, Learnlink, designed to expedite communication amongst teachers, student science partners and faculty mentors; and 5) a focus on the cultural and gender-equity issues that underlie the changes required to achieve science education reform.

Project goals include: 1) teachers becoming self-motivated learners, actively seeking further training in science and guided-discovery instruction; 2) teachers becoming more willing and able to use inquiry science hands-on materials and minimizing their use of rote memorization of facts and vocabulary in science teaching; 3) teachers being sensitized to gender-equity issues in science instruction; and 4) generating excitement, enthusiasm and curiosity among the children in the *ESEP* schools about learning science and mathematics.

Impact: 1 district; 72 schools; 1,600 teachers; 30,000 students.
NSF Support: $5,699,850; ***Cost-Share:*** $7,254,837.

UIC-ALL Learn Mathematics

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The All Learn Mathematics project is a three-year project designed to improve the mathematical understanding and the classroom pedagogy of middle-grade teachers of mathematics in Chicago Public Schools, grades 5-8. The project provides 100 hours minimum of enhancement for each teacher over two years in eight summer institute days, monthly after-school sessions, and project staff participation in classrooms. Teachers work in cadres to build collaborative networks in addition to the specific enhancement. The project assists teachers and administrators in building parental support and a students helping students environment in the school. The project targets schools in the *Chicago Systemic Initiative* and develops cadres of 50 teachers in each of Chicago's ten subdistricts.

The ten groups selected for participation each involve middle-grade teachers who participate in teacher professional development where strengthening the mathematical competencies is a high priority. An important portion of all the workshops are problem-solving sessions, where teachers are actively involved with exploring, sharing and discussing mathematics. This provides teachers an opportunity to learn more mathematics and develop more accurate beliefs about mathematics. The sessions encourage teacher discourse about all classroom issues -- curriculum content, classroom management, and equity.

The curriculum materials the teachers take with them to the classroom include the NSF-supported *UIC-Maneuvers with Mathematics* project. Teachers receive implementation support through regular, in-school visits by a support staff person and on-line support via the Internet. Follow-up support is also provided to expand the mathematics leadership of principals.

Systemic reform will be sustained through an increase in parental and principal participation through Math Nights and Family Math programs. Leadership committees in each school are responsible for continuous improvements in the mathematics program and the training of staff development leaders.

Impact: 1 district; 60 schools; 600 teachers.
NSF Support: $1,782,417; ***Cost-Share:*** $1,176,267.

The Chicago Secondary Mathematics Improvement Project

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The Chicago Secondary Mathematics Improvement Project is designed to help Chicago Schools:

- implement Chicago's new graduation requirement of three years of high school level mathematics;
- provide a quality mathematics education for all students; and
- align curriculum and teaching practices with city, state and national goals and assessment practices.

The vehicle for attaining these goals is the *Interactive Mathematics Program (IMP)* - the first of five NSF supported high school comprehensive mathematics curriculum projects to be completed. The project provides a broad professional development program for teachers who work in schools that have elected to implement the *IMP* curriculum.

The project works with 200 teachers in approximately 15 Chicago public high schools over three years to assist schools with *IMP* implementation. Spring and summer workshops and in-school support during the academic year are essential components of the project. The development of teacher leadership and a plan for providing long-term support beyond the funding period of the grant are also included.

The project is grounded in the experience and practice of three years of successful, NSF-supported pilot *IMP* implementation in Chicago and builds upon on work that began in 1990 as part of the College Preparatory Mathematics Program, a project that with partial NSF support, led to increases in student achievement and persistence in mathematics for African American and Hispanic students in Chicago.

Impact: 1 district; 15 schools; 200 teachers; 20,000 students.
NSF Support: $907,396; ***Cost-Share:*** $721,430.

Building Bridges to the Future: The Next Generation of Science-Enabled Elementary School Teachers

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This Local Systemic Change Through Teacher Enhancement project is the result of a collaboration between 13 small rural school districts, one large urban school district and Ball State University. The project combines the resources of the school districts, the university, the Indiana Department of Education, private organizations, and the community to institute and support an integrated, inquiry-based, hands-on science curriculum in the elementary schools of the region. The project is an example of the university and school districts that have teachers, previously trained by past NSF projects, who are ready to become leaders in the district-wide efforts.

This group of lead teachers work with scientists, science educators, and master teachers to plan and staff the summer leadership institutes and form a leadership team core at each school site. The role of the school team is to mentor and educate teachers in elementary science teaching and reform. The team members participate in three summer institutes and academic year follow-up courses. Each year they mentor new teachers who becomes part of the leadership team and participates in academic year classes. This mentoring process is repeated each year with a total of 650 teachers directly impacted by NSF funds. This number represents all teachers per school for 40 schools in 13 school districts.

The curriculum to be implemented includes nationally validated materials and NSF-supported *Full Option Science System (FOSS), EDC-Insights, Science and Technology for Children (STC), Great Explorations in Mathematics and Science (GEMS), and STARLAB* materials as instructional modules for the school districts.

Impact: 14 districts; 40 schools; 650 teachers; 13,000 students.
NSF Support: $2,017,590; ***Cost-Share:*** $805,141.

Indiana Mathematics Initiative

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The Indiana Mathematics Initiative (IMI) is a five-year teacher enhancement and curricular implementation effort involving a partnership among Indiana University, the Middle Grades Network, and twelve urban school districts in Indiana. The project provides extensive professional development experiences of 132-180 hours for each of 445 mathematics teachers and administrators in 62 middle and secondary schools that are fully committed to mathematics education reform at all grade levels. The experiences are designed to enable each teacher to use effectively one of four sets of NSF-supported middle school instructional materials (*Connected Mathematics*, *Mathematics in Context*, *Seeing and Thinking Mathematically*, or *Six through Eight Mathematics*) or one of four sets of NSF-supported secondary school materials (*Core Plus*, *ARISE*, *Interactive Mathematics Program*, or *SIMMS*).

Submitted under the guidelines for *Local Systemic Change through Teacher Enhancement in-Mathematics, Grades 7-12,* the project seeks to create significant changes in how the teachers perceive mathematics and how it is learned, as well as in their views of their roles in middle/secondary mathematics classrooms. These changes are being effected in a variety of ways: (1) intensive and extensive meetings, seminars, and workshops involving the teachers, IMI staff, and representatives of the curriculum projects; (2) continuous support and technical assistance by IMI staff following seminars and workshops; (3) leadership development of lead teachers, district curriculum coordinators, and other school administrators to insure sustained, systemic change; and (4) coordination with current state reform efforts, especially Indiana's upcoming mathematics textbook adoption process.

Impact: 12 districts; 62 schools; 445 teachers; 45,000 students.
NSF Support: $2,002,500; ***Cost-Share:*** $2,007,465.

Science Connections Project

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The Science Connections Project is a five-year professional development program for 320 middle schools science teachers in the county system. The goal is to extend the revised elementary science program into middle schools and to provide the professional development at the middle school level. The project, in cooperation with the University of Maryland, The American Physical Society, and the National Institutes of Health provides intensive training for middle school science teachers, Grades 6-8, so that students who were taught by elementary teachers participating in the NSF funded elementary teacher enhancement project continue to develop science literacy skills and knowledge using inquiry-based and constructivist-based learning. The middle school science teachers receive professional development in science content; and instructional pedagogy, which includes a constructivist approach, cooperative learning, and inquiry-based teaching; performance teaching and assessment; and technology applications. An action research model will be used to promote permanent and ongoing change in teachers' professional development.

Impact: 1 district; 31 schools; 320 teachers; 24,695 students.
NSF Support: $1,406,395; ***Cost-Share:*** $2,588,329.

Mathematics: Applications and Reasoning Skills (MARS)

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MARS, sponsored by the University of Maryland at College Park with subcontract to Baltimore City Schools, is a 4-year Local Systemic Change project to enhance all of the K-5 teachers of mathematics in the Baltimore City Schools. The enhancement is aligned with national standards and the Maryland State Outcomes in Mathematics. It is focused on adult-level mathematics content, instructional methods to promote student understanding and problem solving, research on children's learning of critical mathematics constructs, mathematics curriculum standards, performance assessment, strategies to increase math achievement and preparation of urban students, and community resources for continuing mathematics education.

Cohorts of schools participate in two-year enhancement cycles. All teachers in a building receive at least 100 hours of enhancement starting with a 14-day summer institute, which includes work with students in a summer program. Teachers are required to complete 15 hours of professional development during the first year of implementation and an additional 13 hours in the second year of implementation. Three lead teachers, selected from within the building, receive 60 hours of advanced leadership training and support during the year prior to that building faculty's first summer. A cadre of exemplary teachers are released from the classroom for up to six years to be prepared and to serve as project resource teachers. There is one resource teacher for every three schools to act as peer coach, program monitor, and teacher consultant and give day-to-day support in that school. Principals will participate in quarterly meetings during this period.

MARS establishes faculty partnerships across higher education facilities in the City of Baltimore to support the co-development of continuing mathematics education courses addressing mathematics content, mathematics pedagogy, and the integration of mathematics and science. There is collaboration with the Baltimore *Urban Systemic Initiative* project.

Impact:: 1 district; 180 schools; 2,300 teachers; 90,350 students.
NSF Support: $5,999,000; ***Cost-Share:*** $1,587,819.

Joint Proposal for the Dissemination of the Interactive Mathematics Program throughout New England

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Northeastern University is working with twenty school districts in New England to change their curriculum and pedagogy to meet the NCTM Standards. These school districts are joining with the New England Regional Center for the Interactive Mathematics Program (IMP), the Center for Enhancement in Science and Mathematics Education, the Center for Innovation in Urban Education and the Mathematics Department at Northeastern University to implement the NSF-funded *IMP* curriculum in their schools. The *IMP* curriculum replaces the traditional four years of high school mathematics with units that integrate algebra, geometry, statistics, finite mathematics and pre-calculus. The units are designed to be taught in collaborative groups, therefore changing the pedagogical approach from teacher centered to student centered.

Teachers receive extensive professional development before each year of teaching the *IMP*. They participate in a two-day retreat in the spring, a 4- or 5-day summer workshop, and five days of professional development sessions during the academic year. In the sessions, teachers work in collaborative groups discovering the concepts and expanding their content understanding just as the students do. Through experiencing the units, the teachers are better able to implement the curriculum and pedagogy. On-going support is provided through periodic class visits. By the end of the project, each school district will have lead teachers trained in all four years of *IMP* to carry on the training and serve as a resource to the other teachers.

Impact: 20 districts; 20 schools; 252 teachers; 25,581 students.
NSF Support: $1,133,995; ***Cost-Share:*** $1,106,827.

Reaching Every Teacher: A Systemic Approach to Increase Student Achievement K-12

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This is a 3-year project by the Waltham Public Schools, in collaboration with Education Development Center (EDC), to launch a multiyear, districtwide, systemic reform of the city's entire K-12 mathematics program. Waltham faces many of the challenges of urban schools with a growing minority population (28%) which is predominately Hispanic and 25% of the students having English as a second language.

The foci are to (1) deepen teachers' understanding of mathematics, (2) help them view mathematics as a problem solving discipline, (3) enhance their pedagogical skills to include the use of technology and inquiry driven classroom techniques, (4) promote cross-grade dialogue to make K-12 mathematics instruction an integrated whole, and (5) enhance their abilities to choose curriculum wisely. The project involves all 200 of the district's teachers of mathematics in 10 days of teacher enhancement each year. EDC staff and outside experts in mathematics and mathematics education lead the seminars involving the cross-grade teacher groups.

Teacher liaisons, chosen for their desire in a leadership role, assist EDC staff in planning the seminars and maintaining a school based connection for other teachers, administrators and parents. The teacher liaisons will solely lead the seminars in the third year where teachers pilot units from curricula that are under review for adoption systemwide. Local industries and universities provide volunteers to substitute for teachers while they attend the professional development seminars. Also, administrators, principals, and parents are involved in selected seminars each year. The teacher participants are offered graduate credit, through Fitchburg State College, or in-service credit to fulfill the professional development requirements set forth by the State of Massachusetts.

Through the community involvement in the project, the students are able to connect their work in mathematics to the real world and a capacity to maintain change after the life of the project is developed. The district reform model will be disseminated through the production of a manual describing the project with suggestions for adaptations by other small-city districts.

Impact: 1 district; 4 schools; 200 teachers; 5,332 students.
NSF Support: $899,815; ***Cost-Share:*** $1,440,467.

Midland Public Schools Systemic Change Teacher Enhancement Institute

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The Midland public schools in collaboration with the Herbert H. and Grace A. Dow Foundation, the Dow Chemical Company, the Michigan *Statewide Systemic Initiative* Project, and Michigan State University are pulling their efforts together to enhance all their elementary teachers in science. This effort is a continuation of a systemic change project begun in 1989 that focused on elementary science. At that time, the project was partnered with the community and successfully developed a centralized materials and technical support system. The current three-year project includes a Teacher Enhancement Institute that provides professional development for elementary (K-6) teachers. The teachers gain knowledge in science content and teaching skills at the same time meeting the numerous needs of their students.

The institute consist of a two-week summer institute for an initial group of twenty-four (two from each of the 12 schools) who are prepared to become science mentors in their schools. A final week of training occurs during the school year. These teachers continue to attend the institute for three consecutive years. In subsequent years, an additional 70 teachers and 24 substitutes will participate with the core group of 24 leaders. The institute's goals are 1) to ensure teaching for conceptual understanding; 2) to develop an understanding of the nature of science inquiry; 3) to strengthen teacher's knowledge of basic science concepts, applications, and connections to other disciplines, and; 4) to use methods of ongoing assessment of effective teaching and learning.

Community scientist receive instruction on how to assist teachers and students in determining what has truly been learned. Parent volunteers and elementary school principals each participate in an institute preparing them to be articulate advocates of reform in science literacy and science education. The project plans to establish a network of mentors, facilities and community participants to ensure that systemic change occurs and is sustained.

Impact: 1 district; 12 schools; 308 teachers; 5,900 students.
NSF Support: $713,329; ***Cost-Share:*** $1,230,014.

Renewing Mathematics Teaching through Curriculum (RMTC)

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Renewing Mathematics Teaching through Curriculum (RMTC) is a collaborative of fifteen high schools in southwestern Michigan that have recently adopted the *Core-Plus mathematics Project (CPMP)* instructional materials in their quest to improve mathematics teaching so that *all* students can develop mathematical power. In this four-year professional development and curricular implementation project, all 154 mathematics teachers in the targeted schools participate in an integrated, reflective cycle of teacher enhancement activities comprised of two-week summer sessions, biannual meetings of all participants, and regular and frequent contact among teachers in school buildings that includes peer mentoring, class observations, common planning periods, and small-group meetings. Each teacher participates in an average of 382 hours of professional development over a three-year period.

As a *Local Systemic Change through Teacher Enhancement in Mathematics, Grades 7-12,* project, RMTC has five key elements: (1) RMTC is integrally connected with the exemplary curriculum that the collaborative teachers use in their classrooms; (2) the approach that RMTC takes to professional development is consistent with the approach the exemplary curricula take to student learning; (3) RMTC acknowledges that systemic change in mathematics education requires the commitment and understanding of the communities beyond the mathematics department and school; (4) RMTC takes advantage of the unique strengths the individual schools bring to the collaborative to help in overcoming each other's weaknesses; and (5) the formation of RMTC was initiated by teachers and continues to be guided by both teachers and administrators in the collaborative schools.

The project will also produce products to share the ideas generated by RMTC with other districts that are facing the challenge of implementing an innovative mathematics curriculum. A WWW site will permit immediate dissemination of information and, by the conclusion of the project, summary projects will be produced in multimedia format (CD-ROM), as well as paper copy.

Impact: 12 districts; 15 schools; 154 teachers; 15,500 students.
NSF Support: $707,957; ***Cost-Share:*** $759,399.

Minneapolis Public Schools (MPS) Systemic Change in Science Initiative

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This 5-year Local Systemic Change project in Minneapolis reaches approximately 1,600 grades K-8 teachers in 62 elementary and 8 middle schools. All teachers receive a minimum of 100 hours of professional development in science, with the 300 leadership teachers being involved in 240 or more hours. The professional development is expected to provide all Minneapolis teachers with the science content knowledge and instructional skills they need to implement the district's new inquiry- and standards-based science curriculum. Principals and school administrators from the district's elementary and middle schools will undertake professional development to enhance their leadership skills in the alignment of science curriculum, instruction and assessment in their schools. An important goal of all the proposed project activities is to change the belief systems that have perpetuated the public perception that science is not for all children. A coalition of science professionals has been formed that includes Minneapolis teacher leaders and district administrators, higher education faculty, informal science educators, and representatives of local corporations and community organizations. A substantial effort is underway in Minneapolis to recruit teachers who represent the diverse groups represented in the schools' student population, which is now 63 percent students of color. Approximately 25 percent of the new teachers hired in the last five years are from groups traditionally underrepresented in the sciences.

One component of the Minneapolis Local Systemic Change project will be to develop stronger linkages between the Minneapolis Public Schools science program leadership and the state's higher education institutions that train the majority of future Minneapolis teachers, with the goal of moving preservice teacher training in science closer to the MPS standards for science curriculum, instruction and assessment.

The services of the district's two science centers that have traditionally provided hands-on science instructional materials to elementary school teachers will be expanded to include materials distribution to middle school teachers and science professional development coordination for the entire district. Principals and science leadership teachers at the school sites will determine the scope of services offered by the centers as part of a "buy-in" plan to be implemented over the five-year term of the project. Teachers at 8-10 "model schools" will experiment with various approaches to aligning the science curriculum with best practices in instruction and assessment.

Impact: 1 district; 70 schools; 1,680 teachers; 32,073 students.
NSF Support: $5,034,000; ***Cost-Share:*** $3,454,000.

Minneapolis and St. Paul Area Merging to Achieve Standards Project (MASP)2

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Twenty-four Minneapolis/St. Paul metropolitan area K-12 school districts, acting in a comprehensive collaboration, are participating in this project. By the year 2002, five hundred teachers, representing all or nearly all grade 7-12 mathematics teachers in these districts, will be teaching a standards based curriculum to very diverse populations of students. This project creates a critical mass and an infrastructure for the development of a systemic implementation in all schools by all teachers in the Greater Minneapolis/St. Paul area and beyond. This project operationally defines "implementing a Standards Based Curriculum" as teaching one (or more) of the new NSF middle or high school curriculum projects or newer curricula packages which have direct and verifiable linkages to the National Council of Teachers of Mathematics Curriculum & Evaluation Standards for School Mathematics, Professional Standards for Teaching Mathematics, Assessment Standards for School Mathematics and other supporting documents.

The project provides for a variety of ongoing teacher support structures, and, for multiple time frames within which teacher teams can implement Standards Based Curricula. Those who will, from the beginning, fully implement such a curriculum, attend a two-week intensive summer workshop on both content and pedagogy related to the new curricula followed by academic year staff development and mentoring at Saturday or after school workshops. A reduced level of mentoring during the second year completes the set of sponsored professional development activities. A parallel set of workshops prepares other teachers to select and implement portions of a Standards Based Curricula and prepare to move to the full implementation stage in succeeding years of (MASP)2.

Each teacher receives at least 130 hours of professional development activity. The project works with districts to assist in the identification and selection of curriculum materials and to train and support mentors through cognitive coaching and leadership workshops. These mentor/leaders are the core of the ongoing implementation of curricula in partner school districts.

A major goal of this project is to develop and implement a replicable model for large-scale selection and implementation of major curriculum reform. The model is based on long-term, purposeful and planned professional development for each 7-12 participating mathematics teacher, and on the development of long-range, skilled leadership teams in every school.

Impact: 24 districts; 75 schools; 500 teachers; 50,000 students.
NSF Support: $2,249,596; ***Cost-Share:*** $1,000,000.

KEYSTONE: A Rural Regional Training Program for Excellence in Science and Technology

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This project is the Bozeman School District's comprehensive plan to implement a rural regional K-8 teacher-training program that was developed under an NSF planning grant. The project is combining the resources of 19 rural school districts, four Indian Reservations, Montana State University, Museum of the Rockies, professional scientists, local businesses, parent groups and current NSF initiatives in the state to establish self-sustaining science and technology programs and to disseminate a staff development model. The project is tied to the Montana *State Systemic Initiative (SSI)* so *Keystone* can enhance the state efforts by providing staff development for all teachers and administrators, not just preservice and newly hired teachers. The SSI supports the project by providing mentoring services to newly hired teachers and some materials to the four districts we both serve. The result of this project is to create the appropriate training design, yet universal enough to serve as the statewide model for rural cooperative teacher in-service programs.

Bozeman's school district and 22 consortium districts serves 6,300 K-8 students. Many schools in the consortium have multi-age classrooms, providing teachers with multiple grade assignments. Some schools are K-5, K-8 or K-12. The curriculum to be implemented includes NSF funded *EDC-Insights*, *Full Option Science System (FOSS)* and *Science and Technology for Children (STC)* materials.

Over the life of the project, participants attend summer workshops where half of the time is devoted to hands-on units. Teachers also learn how better to serve the Native American population and how to interest females in mathematics and science professions. Additional workshops are being offered throughout the school year and teachers are required to participate in a minimum of two professional development activities conducted by the state or at the university. Professional scientists work side by side with the teachers and act as role models during the workshops.

After the workshops, teachers are paired to a resource scientist and to a learning circle made up of teachers with similar interests, through various methods of telecommunications such as the Internet and 1-800 bulletin boards. Such telecommunications are being utilized extensively due to distance barriers in these rural areas. The scientists also serve as advocates on local school boards and community groups to support the implementation of national reform at the local level. There is also a materials distribution system, which is housed in one of the school districts, and it serves as a good model for rural area school districts.

Impact: 23 districts; 48 schools; 518 teachers; 6,300 students.
NSF Support: $1,741,238; ***Cost-Share:*** $928,000.

The Mathematics and Science Enhancement II (MASE II)

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This collaborative effort between the Clark County School District and the State of Nevada provides innovative measures to reform elementary science and mathematics education for grades K-5. This project is a systemic reform initiative that is grounded in a vision of inquiry learning, based on research and National Standards and supported by Clark Country School District personnel, scientists, educators, and community leaders. The project is designed to increase student learning in mathematics and science by enhancing teachers' and administrators' knowledge of science and mathematics content, pedagogy and learning research.

The Clark County School District is located in Las Vegas, Nevada and is the 9th largest school district in the country. The district covers 7,910 square miles and has 181 schools in urban and rural settings, 127 of which are K-5. The student population has a wide range of socioeconomic levels with 65 of the schools considered to have high-needs students. This school district is constantly growing in size with a disproportionately high number of disadvantaged students. This trend is expected to continue and as a result, the district faces a continuous challenge of tailoring the curriculum to meet the needs of its students.

This five year project is a continuation of the NSF-supported *Mathematics and Science Enhancement (MASE) Project I. MASE II* enlarges the circle of educators and community members who are advancing reform efforts and shaping the learning environment in each K-5 school and ultimately in the state of Nevada. *MASE II* engages all 2,040 teachers in 60 schools. It is centered around six teachers on Special Assignment, 80 *MASE* teacher leaders and 20 *MASE* Administrators. Teachers are engaged in 100 hours of professional development over the course of three years. Approximately 40 of the 100 hours are based in the classroom setting.

The professional training of the project involves teachers learning mathematics and/or science content through inquiry. In addition, teachers interview children, observe exemplary teaching, make conjectures, work with their own children, and come back together to share results and plan.

Aside from increasing teachers' and administrators' understanding of mathematics and science content and pedagogy, other goals have been established by *MASE II*: 1) infuse exemplary curriculum and resources materials into all schools; 2) increase the pool of knowledgeable teacher leaders to meet the growing demand for substantive on-going professional development; 3) increase the involvement of parents in information and hands-on sessions; and most importantly, 4) provide quality mathematics and science education for all students as evidenced through improved teaching methods, increased student performance, and enhanced quality of learning.

Important partners and alliances of this project include the Nevada State Department of Education, Scientists from the Department of Energy, Desert Research Institute and University of Nevada, Las Vegas' Women and Science and Engineering Program and Lied Discovery Children's Museum.

Impact: 1 district; 60 schools; 2,040 teachers; 46,000 students.
NSF Support: $6,000,000; ***Cost-Share:*** $8,108,950.

The Partnership for Systemic Change: A School/Business Collaborative to enhance Science, Mathematics, and Technology Teaching and Learning

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This 5-year Local Systemic change project involves four school districts -- Linden, Rahway and Readington Township Public Schools in New Jersey and the North Penn School District in Pennsylvania. The districts entered into a partnership with the Merck Institute for Science Education (MISE) in 1993 to improve K-8 science education, stimulate education reform and raise the scientific literacy of American youth. Each of the districts interacts differently with MISE due to their unique histories so each district is currently at a different stage in SMT reform.

The partners envision an increased knowledge of science, mathematics and technology (SMT) and mastery of an inquiry approach to teaching for teachers and administrators; classrooms where students' interests and curiosity are stimulated by teachers who pose questions and challenge students to construct their own learning; schools which provide a network of support for inquiry and a context for sustained learning; and districts where parents, the community, corporations, and teachers and administrations share the responsibility for improved teaching and learning of SMT. In order for the project to reach these goals, it provides professional development for 825 teachers in 35 schools, promotes inquiry-centered learning for all students, engages the stakeholders in systemic reform, and disseminates information to encourage project replication.

The professional development program has four components -- Lead-Teacher Institutes, Peer Teacher Workshops, District Inservices and Additional Professional Development Opportunities. During the professional development, teachers explore the content of the curriculum modules – NSF-funded *STC*, *FOSS*, *GEMS*, *EDC-Insights*, *National Geographic Kid's Network* and *TERC's Investigations in Number, Data, and Space*. The Lead Teacher Institute is an intensive three-year program for teams of teachers and administrators from each elementary and middle school in the district. Specialists in science and mathematics content lead each team. The goal is to build a cadre of lead teachers to lead SMT reform. Lead teachers responsibilities include mentoring new teachers, peer coaching, and development of assessment and presentation of professional development programs to peers.

The lead teachers plan and in some cases provide instruction at the Peer Teacher Workshops. The workshops enhance teachers' abilities to use the science modules, mathematics materials and supporting technology for their grade level and improves skills in integrating SMT and using a variety of assessment strategies. District inservices are available during the course of the project and are customized to meet each district's needs. Additional professional development opportunities are available to teachers such as: team teaching, participation on committees to align curriculum with standards, develop assessment tools, select curriculum materials and writing and implementing mini grants.

A network of Merck scientists and engineers volunteer their time and expertise to assist teachers in classrooms, demonstrate science and computer technology and serve as role models for the students. A Materials Distribution Centers has also been established in each districts to distribute and replenish materials.

Impact: 4 districts; 35 schools; 825 teachers; 23,100 students.
NSF Support: $2,412,812; ***Cost-Share:*** $4,743,449.

Great Ideas In Science Consortium: Partners for Integrated Science Curriculum Reform

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This Local Systemic Change project is a collaboration between Montclair State University and the school district of East Orange and Jersey City, New Jersey. The project targets the entire population of K-8 teachers in both districts. The New Jersey State Department of Education has identified East Orange and Jersey City districts as "critical needs" districts requiring special help. The Jersey City district has been taken over by the New Jersey Department of Education because of poor student performance. East Orange and Jersey City have 98 and 89 percent minority student enrollments respectively: the East Orange population is almost exclusively African-American while Jersey City is a major center of immigrant settlement with more than 70 ethnic groups represented, the largest contingency being Hispanic. Up to 40 percent of the teachers are minorities.

A series of summer institutes, an experimental Living Laboratory for practice teaching and peer mentoring, school year outreach activities, and teacher-run, in-service workshops make up the enhancement program. The program has four components designed to: (1) expand teacher knowledge of subject matter, (2) increase understanding of inquiry-based and process-oriented techniques, (3) promote the integration of Science, Mathematics and Technology (SMT) with other portions of the curriculum, and (4) increase teacher confidence in teaching and develops teacher leaders to institutionalize the program beyond the grant period. The first cohort of 120 teachers receive 120 hours of staff development in the first year. Thirty teachers from the first year return a second year to become teacher leaders. The goal is to reach 540 to 570 teachers directly over the five years. The rest of the K-8 teachers are reached by the Consortia staff and Outreach teams working in close cooperation with school teams to bring regular in-service activities into all the schools in both districts, for at least 100 hours over the five years of the project. The curriculum in the schools are selected from nationally validated instructional programs, in particular *Science and Technology for Children* (STC). The workshops enable teachers to learn science content and math concepts through inquiry based hands-on approaches.

Impact: 2 districts; 44 schools; 1,000 teachers.
NSF Support: $2,824,391; ***Cost-Share:*** $1,046,585.

E=MC2

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"Building Bridges to the Future" is a consortium of three New Jersey school districts -- West Windsor-Plainsboro Regional, Ewing and Lawrence Townships -- and seven research and development centers including American Cyanamid, Bristol Myers Squibb and Union Camp that promotes an inquiry approach to the teaching of elementary science. This 5-year project targets every elementary teacher in the three districts, including ESL, bilingual and special education teachers in the 15 schools.

Teachers receive professional development through summer institutes, participation in monthly support/share groups, and with mentoring throughout the school year. Teachers gain an understanding of how elementary children learn science; how to empower students' to conduct investigations, ask questions, and work cooperatively in groups; develop a knowledge base to facilitate an inquiry-based science program; learn how to use the available technology; develop strategies to promote equity; and gain the knowledge to use, interpret and create authentic assessment instruments. Forty mentor teachers are assigned to the school districts, proportionately, to help teachers make the transition from a textbook program to a hands-on approach utilizing the NSF-supported instructional materials.

Twenty-six volunteer K-6 teachers have already begun to pilot FOSS, Insights and STC science modules in their classrooms. They will then make recommendations for adoption by the school board. A central Science Resource Materials Center will store and replenish the activity-based modules and distribute them to the teachers.

Additional science and education expertise will be provided by faculty from Princeton University, scientists from Sigmi Xi - the scientific research society, the American Physical Society and AAAS, Trenton, NJ.

Impact: 3 districts; 15 schools; 574 teachers; 13,550 students.
NSF Support: $1,722,000; ***Cost-Share:*** $5,292,078.

TEAM 2000

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Team 2000, a partnership between the Buffalo City School District and the Buffalo Museum of Science, is developing an inquiry-based, concept-oriented instructional program in science and mathematics for students in grades K-8 over a five year period. This partnership produced the Nation's first elementary school physically attached to a museum. Teachers participating in the project receive 100 hours minimum of hands-on professional development. They are trained to teach three grade-appropriate nationally validated hands-on science kits. There is a kit designated for each of the three subjects areas that comprise the science curriculum: life, earth and physical sciences. The curriculum kits are based on materials taken from *EDC-Insights*, *Science and Technology for Children (STC)*, *Museum to Go,* and *Full Option Science System (FOSS)*.

The teacher workshops involve examinations of alternative assessment, cooperative learning strategies and working with museum curators and other scientists to enhance their understanding of science. By providing this professional development to the Districts' teachers, Buffalo plans to make kit-based science teaching and inquiry-based instruction the core of the science curriculum. Participation from the larger community and local businesses provides the continued support to make this happen.

As *TEAM 2000* prepares for the implementation of a comprehensive K-8 science program in all of Buffalo's sixty-one elementary schools, a Science Materials Center and a Center of Inquiry at the Museum will support these educational reforms. *TEAM 2000* offers three-week summer institutes, Saturday workshops and after school seminars dedicated to advancing inquiry-based teaching and learning. Principals also need an understanding of the teaching philosophy, so *TEAM 2000* plans to launch a program of "sunrise seminars" to address the issues of administrative support and provide on-going professional development opportunities for principals.

This project is compatible with New York's Systemic Initiative's objective of promoting an inquiry-based science program and providing a framework for the implementation of a learner-centered instructional program. By meeting these objectives, Buffalo Public Schools will eventually have all 1,400 K-8 teachers teaching inquiry-based science.

Impact: 1 district; 61 schools; 1,400 teachers.
NSF Support: $41,999,514; ***Cost-Share:*** $1,960,000.

"SMART PROCESS" - Local Systemic Change Through Teacher Enhancement

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The *SMART Process* is a collaborative effort among Community School Districts (CSD) 3 and 5, local industry and the community in New York City to systematically reform science education for grades K-6 by providing teacher enhancement and support. The private sector, represented by Colgate-Palmolive is providing important services associated with the management, replenishment and transportation of the science instructional kits. The curriculum kits to be implemented include NSF supported *Science and Technology for Children (STC)* and *EDC-Insights* materials as instructional modules. Over the five-year period, science teaching and learning in grades K-6 are expected to improve for teachers and students through systemic teacher enhancement activities. Mathematics and technology are also integrated into these activities from the onset of the project.

The *SMART Process* involves all 35 elementary schools in CSDs 3 and 5 with a population of 28,784 students, of which 21,535 are elementary students. Community District 3 and 5 are located in Harlem on the upper west side of Manhattan, New York. This area of New York City comprises a diverse ethnic population and of low-income families. Ninety-two percent of the elementary school population are ethnic minorities and 14 percent are limited English proficient students.

Teacher enhancement of this project affects all the elementary teachers. A teacher survey discovered that 71 percent have taken fewer than six credits of science and that 68 percent teach science fewer than 2 hours per week. Seventy-nine percent also indicated that they are uncomfortable teaching science. The vast majority of the elementary school teachers are teaching very little if any science, and they lack significant knowledge of science content or constructivist methods.

These findings prompted the onset of science education reform in these communities. The *SMART Process* is being implemented under a phase-in model. During the first year, nine schools are involved and in the additional years, the other schools are phased in until all schools in the district are involved. Over the five year period, teachers receive over 100 hours of professional development concentrating on four areas: 1) use of modular kits and content; 2) study groups and congresses; 3) inquiry-based methods and content; and 4) in-classroom demonstrations. Once the teachers have adapted to the use of inquiry-based methods in the teaching of science, professional development activities will be expanded to focus on the mathematics and technology content areas.

Parents, school-based administrators and professional scientists, mathematicians and engineers are also receiving professional training as part of the program. Parents devote 30 hours to enriching their knowledge of family science and mathematics through workshops, classroom participation and various other activities. School- and district-based administrators receive 60 hours of training to provide support to systemic reform, facilitating the *SMART Process* and an understanding of inquiry-based teaching and learning. Through 15 hours of workshops professionals are also taught more about inquiry-based learning and teaching.

The primary partners and alliances of this project are The Workshop Center at City College, Education Development Center, Inc., Science Institution Teacher Enhancement Collaborative, New York City Urban Systemic Initiative and New York State Systemic Initiative. These involved constituencies provide sustainable support to ensure the success of this project to change science education at the elementary school level.

Impact: 2 districts; 35 schools; 1,470 teachers; 21,535 students.
NSF Support: $4,405,879; ***Cost-Share:*** $11,606,447.

Making Mathematics Reform a Reality in Middle Schools

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The University of Rochester (NY), in collaboration with SUNY - Geneseo, targets all 48 middle school mathematics teachers in four Rochester area schools in an experimental model for Local Systemic Change through Teacher Enhancement in Mathematics. The four-year project has a concomitant "research in practice" component involving the ethnographic study of the reform efforts undertaken by the four schools and an evaluation of the outcomes of such efforts. The research is expected to yield both basic and applied findings about "best practices" for systemic reform in mathematics, especially at the middle school level.

The teacher enhancement component includes introductory and advanced summer institutes and academic year inservice activities that support teachers, school administrators and parents as they build a shared vision for school mathematics. Each of the 48 teachers receives at least 140 hours of professional development in two 2-week summer institutes followed by related field experiences. These experiences are appropriate for different stages of teacher enhancement so participants sustain growth over multiple years. Teachers also deepen their understanding of mathematical content and pedagogical approaches by engaging "as learners" while increasing their understanding of their students learning process. Of these 48, 8 lead teachers receive a minimum of 220 hours of professional development. These lead teachers take on leadership roles in the schools, model and mentor for beginning colleagues, and facilitate on-going change.

The professional development is intended to enable teachers to implement four of the NSF-funded middle school curriculum projects (*Seeing and Thinking Mathematically*, *Mathematics in Context*, *Connected Mathematics*, and *Middle-school Mathematics through Applications Project - MMAP*).

Project evaluation addresses (1) the quality and effectiveness of the teacher enhancement component, (2) outcomes of the systemic reform efforts promoted in the four target schools, and (3) the rigor and significance of the associated research.

Impact: 4 schools; 48 teachers; 13,400 students.
NSF Support: $350,259; ***Cost-Share:*** $578,814.

Redefining, Reforming, and Enriching Mathematics Instruction through Problem Solving, K-8 (MIPS Project)

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The Camden County, Edenton-Chowan, Elizabeth City-Pasquotank, Gates County, and Hyde County public school systems in northeast North Carolina collaborate with the University of North Carolina at Chapel Hill, East Carolina University, and Elizabeth City State University in this teacher enhancement project. The project targets all 378 K-8 teachers of mathematics in the participating districts, each for 196-304 hours of professional development in summer workshops and academic-year sessions, linked with classroom implementation of exemplary instructional materials in mathematics. The effort is driven by student needs, national standards, state standards and new requirements for graduation, and North Carolina's new ABC's Program which places accountability for student achievement at the building level, with incentives and sanctions.

Submitted under the guidelines for *Local Systemic Change through Teacher Enhancement, Grades K-8*, MIPS seeks to (1) implement consistent and proven mathematics curricula that promote problem solving and inquiry in the teaching and learning of mathematics, K-8; (2) implement instructional models that are student-centered and focus on quality work; (3) promote and effect an articulated mathematics curriculum that is well integrated with district classroom instruction; and (4) develop sustainable interactions among the collaborating districts, along with the necessary support and teacher leaders to institutionalize the changes made in mathematics instruction, K-8.

The districts initially focus the elementary teacher enhancement and curricular components on helping teachers learn and teach statistics through the NSF-funded *Teach-Stat*. Elementary teachers then participate in further enhancement centered around children's mathematical development, leadership, and implementation of exemplary instructional materials, especially *Investigations in Number, Data, and Space* and *Everyday Mathematics*. Middle grades efforts center around implementation of the *Connected Mathematics Program*.

Impact: 5 districts; 22 schools; 378 teachers; 13,090 students.
NSF Support: $1,134,000; ***Cost-Share:*** $1,445,088.

Project SEEDS: Science Education Enhancing the Development of Skills, K-6

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SEEDS is a community driven and teacher led project that is revolutionizing the way elementary science is being taught and learned in Stark County, Ohio. The Education Enhancement Partnership (TEEP), a local school-business alliance; the Stark County Education Service Center; Ashland University; and 16 surrounding public school districts and 3 private schools have joined forces to implement the *SEEDS* project. The 7 rural, 5 suburban, 4 urban and 3 private and parochial schools consist of 30,000 elementary students and 1,000 elementary teachers of science. Activities are also being coordinated with the NSF-supported *Ohio Statewide Systemic Initiative*.

The goal of *SEEDS* is to develop a hands-on, minds-on elementary science curriculum that is also integrated with the language arts and mathematics to provide an intensive series of professional growth opportunities and options for teachers to stimulate systemic change. This curriculum will meet the recent Ohio State Model Curriculum and state proficiency in science requirements.

Lead teachers/leadership teams (165 teachers), selected prior to the start of the project, receive professional development in leadership skills, content, pedagogy, and authentic assessment in two summers. In the second summer, school districts begin their "Immersion Training" where the leadership teams, along with principals, administrators, and university professors, train other teachers in their districts on the hands-on instructional materials. A constructivist approach is utilized so participants actively learn through hands-on experiences about the exemplary science units that they are to implement in the classroom. These materials are the NSF-funded *Full Option Science System (FOSS), Science Curriculum Improvement Study* (SCIS), and the *EDC-Insights*.

Through the use of a 150-hour Personal Development Plan, district teams and teachers will continue to grow professionally and meet their individual needs. Parental involvement takes place at the district level throughout the project with family science nights, Open House nights, instructional material activities, and newsletters. School principals are also involved through leadership teams which have to participate in training which focuses on concerns of implementation. The institutionalization of the lead teacher/leadership teams will insure the ongoing and continued success of the program.

The networking of teachers and students and the dissemination of materials and ideas is done through a local, state and national electronic communication system, *SEEDSNet*. The SEEDS home page is http://199.218.201.110/.

Impact: 16 public & 3 private districts; 76 schools; 1,000 teachers; 30,000 students.
NSF Support: $3,000,000; ***Cost-Share:*** $2,674,780.

ASSET Teacher Enhancement Project

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The Allegheny Schools Science Education and Technology (ASSET) Inc., a local non-profit consortium of businesses, education and community leaders, was started in 1993 through the leadership of Bayer Corporation, a Pittsburgh-based company with major businesses in health care, chemicals and imaging technologies. In collaboration with ASSET, sixteen of Allegheny County's 43 school districts are working towards systematically reforming science education in their elementary schools. Their efforts are to promote an inquiry-centered elementary science program based on hands-on instructional units and student-centered activity.

Allegheny County is located in the southwestern corner of Pennsylvania. The average per capita income is $15,115 with 11.5 percent of the population at the poverty level. School districts within the County differ considerably in enrollment due to the socioeconomic and cultural differences among the students. Of the 43 districts, enrollment at the elementary level ranges from 851 in Sto-Rox to 40,000 in the Pittsburgh Public Schools.

The project's goal for teachers is to develop conceptual understanding, scientific investigation skills and practical reasoning through the use of inquiry/investigative teaching strategies. Each year, over a five-year period, the project will target a specific area to provide effective inquiry-based instruction. Another component includes leadership training for selected teachers and administrators, implementation training for all teachers, community-based professional development extension options at regional resources for all teachers, and pre-service training at Duquesne University.

By providing teacher enhancement, it ensures that each child, in grades K-6, is exposed to an exemplary core curriculum of hands-on, inquiry-based science, consistent with nationally recognized standards for the teaching of science. The curriculum materials used to implement the project's curriculum are *Science and Technology for Children (STC), Full Option Science System (FOSS),* and *EDC-Insights.* The participating districts have agreed to implement 28 hands-on modules in grades K-6 at four units per year.

It also increases the teacher's self-confidence in teaching inquiry-based science. Teacher support is provided through a Materials Support Center, Assessment and Community Involvement. The Materials Support Center provides materials for ASSET classrooms and guides curriculum planning. The Allegheny Intermediate Unit, a major partner in the development of the Support Center, provides facilities, delivery and pick-up and guidance in labeling systems and selecting computer software. Community involvement comes from work-study students from Duquesne University's Department of Elementary, Secondary and Reading Education, and from parents and other community volunteers who are recruited to refurbish the modules every 8 weeks. Industry scientists play a key support role as they visit classrooms and work with leadership teams. This offers the schools cross-district interaction by encouraging community volunteers and professionals to share their expertise and resources. Thus, ASSET breaks down the barriers between districts and industry to raise the awareness of the public about the importance of science literacy.

Impact: 15 districts; 1,020 teachers; 25,000 students.
NSF Support: $3,059,980; ***Cost-Share:*** $2,129,642.

Pittsburgh Reform in Mathematics Education (PRIME)

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The *Pittsburgh Reform in Mathematics (PRIME)* project is part of a broad systemic initiative in Pittsburgh designed to implement standards-based instruction in all content areas. In this four-year project, *PRIME* supports teachers in the classroom implementation of standards-based mathematics instruction and assessment in grades K-12 through the use of exemplary instructional materials. NSF-funded and nationally validated materials have been considered for adoption, with Everyday Mathematics in grades K-3 and Connected Mathematics in grades 6-8 leading the way.

Pittsburgh Public Schools (PPS) is a large urban district with 88 public schools that are undergoing change to site-based management. Fifty-five percent of PPS students are African - American, of whom 81% are eligible for free or reduced lunch. To ensure that all PPS students obtain the maximum benefit from the exemplary materials, every PPS mathematics teacher at every grade level is being enhanced. *PRIME* helps teachers attain a broad knowledge base in both the mathematics content and successful mathematics pedagogy needed in order to understand and implement the new materials successfully and integrate the use of alternative assessments into their classroom practice.

As a Local Systemic Change through Teacher Enhancement in Mathematics project, *PRIME* provides all Pittsburgh Public Schools teachers of mathematics with a range of activities that include multi-day summer workshops; prime-time, release-day professional development workshops; and individualized, in-class support provided by demonstration teachers and/or mathematics lead teachers within each school. By equipping *all* Pittsburgh mathematics teachers with the knowledge, skills, and support necessary for effectively using exemplary materials and assessments, *PRIME* ensures that *all* students experience a coherent mathematics program that will yield high achievement at *all* levels. Teachers of grades 6-12 receive 234 hours of professional development, and teachers of grades K-5 receive 102-132 hours.

Impact: 1 district; 82 schools; 924 teachers; 40,000 students.
NSF Support: $3,072,000; ***Cost-Share:*** $6,667,560.

The KITES Project: Kits In Teaching Elementary Science

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The *KITES* project, managed by a partnership between Rhode Island College and the East Bay Educational Collaborative (EBEC), is implementing an integrated, hands-on, kit-based science curriculum in the eight school districts in EBEC. The project makes a long-term commitment to bringing this curriculum into the middle and high schools.

The project is organized in accordance with the National Science Resource Center's five essential components for systemic change: 1) curriculum which includes modular, inquiry-centered science kits, 2) professional development, 3) materials support system, 4) assessment methods for evaluating student performance, and 5) administrative and community support. *KITES* also focuses on computer technology, which includes telecommunications and teacher preparation programs. The goals of *KITES* are to replace the current science textbook approach with a hands-on, inquiry-centered, core science curriculum and to nurture changes in understanding, values, practices and policies that lead to a significantly different system.

During the project, elementary teachers receive at least 100 hours of professional development and resources necessary to deliver exemplary inquiry-centered science instruction. *KITES* allows teachers to work cooperatively with academic and industry scientists and engineers in order to teach science more effectively. Science professionals remain linked with the teachers via the Internet throughout the project to build ongoing support and leadership for systemic change. A web site is also being developed for teachers and students to link the kit science themes to the vast resource of the Internet.

KITES is aligning the assessment of science with the inquiry-centered curriculum and is working towards an integrated curriculum where hands-on science is the building block for writing, reading, computing and other basic skills. Teachers are empowered to make instructional decisions and a culture of support is created at the school level.

A materials supply system under the technical assistance of the Boston Federal Reserve Banks is being established for replenishing and distributing the kits to the 52 schools. The kits consist of modules from NSF-supported curriculum: *Full Option Science System (FOSS)*, *EDC-Insights* and *Science and Technology for Children*.

Unique to this project is the linking of students in pre-service teacher preparation programs with project teachers where they co-teach, engaging students in problem solving and a case-oriented approach to teaching and learning. *KITES* is also building partnerships with science-rich institutions such as Roger Williams Park Zoo and the Museum of Natural History.

Impact: 8 districts; 52 schools; 600 teachers; 12,000 students.
NSF Support: $1,800,000; ***Cost-Share:*** $3,900,000.

Metro Nashville Public Schools Systemic Initiative to Improve Science Achievement for All Students

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This is a five-year project to improve science education for all K-5 teachers in 84 elementary schools in the Metro Nashville Public School District. This will be accomplished by providing intensive summer institutes and continuing school year collaborative sessions. The District and Tennessee State University (TSU)'s partnership will initiate and sustain reform by creating site-based and cross-district learning communities. This project represents an innovative model based on partnerships and demonstrates collaboration with public and private stakeholders including parents, the Chamber of Commerce, business and industry, and other members of the learning community.

Metro Nashville schools make up a large urban district with a population consisting of 44.6 percent minority and 51.8 percent economically disadvantaged. The school faculties need professional development to effectively serve these diverse students and community needs in the four districts. Thus, this project recognizes that teachers are at different levels of professional development and offers a variety of teacher enhancement methods and opportunities. All methods reflect a constructivist approach and are inquiry-based with an emphasis on these critical areas: 1) leadership development for teachers and principals, 2) moving towards and beyond the mechanical use of curriculum, 3) new teacher support, and 4) diversity and equity.

There are eight Teachers in Residence who assume the role of full time project staff. They conduct professional development workshops for teachers in a cluster of schools (each cluster serves 8-12 schools) and provide support to 200 additional teachers functioning as School Facilitators. School Facilitators are selected based upon leadership potential and receive additional enhancement. They are available on a day to day basis for peer support. There are teams of two-three School Facilitators at each school. Principals also play an important role in the project and each receive 50 hours of professional training. The intent is that the principals will become the instructional leaders of their schools. A pilot approach to school-wide reform is being developed with several schools.

The curriculum is modular based and includes NSF-supported *Science and Technology for Children (STC), EDC-Insights* and *FOSS* units. All the science disciplines are included in the curriculum. A Teacher Enhancement and Materials Management (TEMM) Center has developed at TSU. The TEMM Center provides professional development and maintains, refurbishes and distributes the kits to the classrooms. Support and enhancement of the content in the curriculum is provided when scientists work with teachers to develop skills in inquiry.

Impact: 1 district; 84 schools; 3,000 teachers; 70,000 students.
NSF Support: $5,145,000; ***Cost-Share:*** $14,011,353.

The Austin Collaborative for Mathematics and Science Education

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Austin Independent School District collaborates with the College of Education and the College of Letters and Sciences at the University of Texas at Austin and with the Charles A. Dana Center at the University of Texas in a 54-month NSF Local Systemic Change project. The project targets all K-8 teachers of mathematics where each teacher participates in at least 126 hours of formal professional development in summer workshops, institutes with students, and academic year sessions. They also receive a minimum of 120 hours of campus level support and classroom coaching, linked with the implementation of comprehensive, standards-based instructional materials in mathematics. The curricula being used are the NSF-supported Investigations in Number, Data, and Space in grades K-5 and the Connected Mathematics Project in grades 6-8.

The Austin Collaborative seeks to 1) build on sound and proven practice in mathematics education, 2) implement consistent mathematics curricula by providing a common learning experience for every teacher in every school, and 3) create a professional development strategy that is intensive, on-going and a part of every teacher's day, every day. Intensive staff development is conducted by grade level, beginning with grades 5 and 6 in the first year and moving outward each year so that once a student starts, there are no gaps in the delivery of the new standards-based mathematics program. In year 2, grades 4 and 7 are targeted.

The summer institute coincides with a lab school experience in which teachers and principals try out some of the new materials and strategies with summer school students. Release days during the following school year give teachers the opportunity to share experiences, reflect and ask questions. Cohort teachers come together in the second summer and the following school year. The third component is campus based and includes work of designated campus mathematics specialists who conduct training and coach or team-teach with teachers in the building. District level mathematics specialists are attached to implementing schools for regular classroom visits and coaching. Campus mathematics specialists and principals receive a minimum of 102 hours of leadership training above the content and pedagogy and materials training that all teachers receive.

Evaluation of the Austin Collaborative for Mathematics Education focuses on student achievement of all student groups, including scores on the state mandated assessment, TAAS; percentage of students passing pre-algebra and algebra; end-of-course exam results for Algebra 1; and enrollment in advanced AISD mathematics courses. Other indicators of the Collaborative impact are the administrative support on each campus for teacher collaboration time, community support, coordinated districtwide professional development, the retention of new teachers, and electronic communication among teachers and their presentations at professional meetings.

Impact: 1 district; 82 schools; 2,400 teachers; 76,000 students.
NSF Support: $5,059,324; ***Cost-Share:*** $5,056,590.

Partnership for Elementary Science Education

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This proposal is for a Local Systemic Change project to improve science teaching and learning in six school districts in Southwest Washington State. In the 5 year project, professional development is customized to meet the specific needs of the 402 grades K-6 teachers who each receive over 140 hours enhancement over a four year period to enable teachers to implement curricula and teaching units consistent with the best inquiry based science teaching. Various levels of support for the teacher participants is provided by full time resource teachers and scientists and engineers from the community who are partnered with teachers to act as a personal resource.

Partners include faculty from science and education departments of Western Washington University, personnel from local business and industry (e.g. Hewlett Packard and American Cyanamid) and the informal science community in nearby Portland, Oregon. A regional materials center supplies the teachers with the instructional materials that are being implemented, such as the NSF-supported *FOSS*, *Insights* and *Science and Technology for Children (STC)*.

Impact: 6 districts; 20 schools; 402 teachers; 9,915 students.
NSF Support: $1,205,593; ***Cost-Share:*** $986,290.

STAFF Leadership for Rural School Districts

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To overcome geographic isolation, limited resources, and professional development opportunities that rarely meet their needs, three rural school districts Riverview, Skykomish and Snoqualmie Valley are capitalizing on the Pacific Science Center's expertise and university collaborations to provide science education reform to their schools. The Center's involvement clearly demonstrates the potentially strong role of the informal science performer. The project prepares each district to raise expectations for science education by obtaining broad community involvement in the design, selection, and implementation of a comprehensive, inquiry-based K-5 science curriculum. The curriculum is based on nationally validated instructional materials. The project also provides staff development for all elementary teachers and establish mechanisms for sustaining reform. Each district provides teacher release time and supporting resources for curriculum and materials management.

Thirty teachers, called STAFF leaders, together with 10 administrators are the leaders in their districts. These STAFF leaders, with guidance from the Pacific Science Center staff and community, receive over 850 hours of professional development in three years. These leaders then provide staff development to each district's entire elementary teaching staff. The goal is to provide all teachers with a minimum 153 hours; principals and administrators with 121 hours; and parents with 32 hours of professional development.

The project is aligned with the Governor's Council of Education Reform and Funding (GSERF) and coordinated with a statewide staff development collaborative consisting of the Center, University of Washington, Western Washington and Washington State Universities, and Battelle Pacific Northwest Labs.

Impact: 3 districts; 8 schools; 193 teachers; 6,139 students.
NSF Support: $711,713; ***Cost-Share:*** $1,004,576.

Hands-On Science in Seattle Schools, K-5

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This 5-year project is involved with developing an inquiry-based, hands-on science program for all the elementary schools in the Seattle Public School District. The purpose is to provide a high-quality science program for all Seattle elementary students where they learn through inquiry and investigation. To achieve this goal, the project is preparing all teachers to conduct inquiry-based, hands-on science in the classroom as well as providing them professional support.

The school district serves approximately 23,000 K-5 elementary students. Seattle's public school district is ethnically diverse consisting of 25% Asian, 22.7% African American, 7.5% Chicano/Latino and 3.2% Native American. Of these, 14.4% are Limited English Proficiency students. Free or reduced-price lunches are received by 42.2% of all elementary students. Teachers, administrators and parents must work together to ensure that the needs of every student are met.

A strength of this project is the partnerships established between the teachers and practicing scientists from the Boeing Company, the University of Washington and the Fred Hutchinson Cancer Research Center. These partnerships are designed to enhance the teachers knowledge of inquiry-based, hands-on science and to familarize scientists with K-6 instructional materials. In addition the volunteer scientists become advocates within the community on the nature and importance of science for all children.

The teacher training is based on a pilot program, research on four existing projects around the country and intensive input from teachers in the District. Teachers receive training in small grade level groups led by a skilled resource teacher/ practicing scientist team. The training also includes school-year in-service training and year-round classroom support.

In the summer institutes, teachers explore science kits, share insights, work cooperatively to solve problems, incorporate technology into their lessons and put into use the pedagogical approaches they will use in the classroom. During the following school year, teachers attend two full-day in-services and four half-day training sessions that enable them to share and evaluate their experiences with the kits. A second summer institute completes the formal training. At the end of the two years, teachers have received 100 hours minimum of professional development and will know how to implement inquiry-based science in the classroom. Their goal is to provide this enhancement to all teachers in the area schools. Subsequently, full time resource teachers continue to support these teachers in the classroom and with in-service days. Scientists also work with teachers and students in the classroom, as needed.

Another strength is the active involvement of administrators, parents and the local community. The principals' receive extensive content training and are responsible for providing school leadership, communicating with parents and generating enthusiasm among the teachers. The parents' support is generated through the Family Science Program that includes an open house for parents where scientists and students teach the parents about science. This program gains support and an appreciation for hands-on, inquiry-based science from families and community members who participate. The community is involved throughout the project in many capacities such as: showing real life connections to the science, mobilizing resources and fostering long term continuance of the project.

Impact: 1 district; 70 schools; 1,400 teachers; 23,000 students.
NSF Support: $4,249,661; ***Cost-Share:*** $3,864,316.

Creating a Community of Mathematics Learners

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Building on a prior-planning grant, this five-year project aims at systemic and lasting change in the way in which mathematics is taught in middle and high schools in six school districts in and around Seattle, Washington. It is based on the belief that creating a community of learners which supports ongoing exploration and improvement is critical to meeting the challenge of providing quality mathematics program for all students. This project involves all 595 middle and high school teachers of mathematics in the six targeted districts.

The project's three major goals are: (1) to provide all middle and high school teachers with at least 132 hours of professional development designed to deepen their knowledge of the mathematics they teach, as well as to increase their understanding and appreciation of successful models of pedagogy, exemplary instructional materials, successful uses of technology, and various issues of assessment; (2) to set up a continuing culture of dialogue and discussion between mathematics educators at all levels (K-16) in the region, aimed at improving the learning environment in each school, with the mathematics teachers in each school acting as the team that spearheads change; (3) to inform parents and the community at large about the goals and methods of standards-based mathematics education, and help them to become effective partners in the enterprise of ensuring excellence in mathematics education. This collaborative project is a partnership between the Department of Mathematics and the College of Education at the University of Washington, and the Bellevue, Lake Washington, Mercer Island, Northshore, Seattle, and Shoreline School Districts.

The 310 middle school teachers and 285 high school teachers participating in the project engage in academic year workshops and discussion sessions, summer institutes, informal working sessions, optional workshops for special purposes (e.g., Internet sessions), and parent and community outreach meetings. A continuing electronic user group is an important strategic component of the project.

Impact: 6 districts; 55 schools; 595 teachers; 110,000 students.
NSF Support: $2,677,152; ***Cost-Share:*** $407,513.

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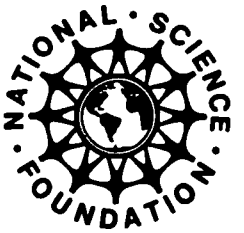
Principal Investigator/Co-Principal Investigator Index

Principal Investigator/Co-Principal Investigator Index



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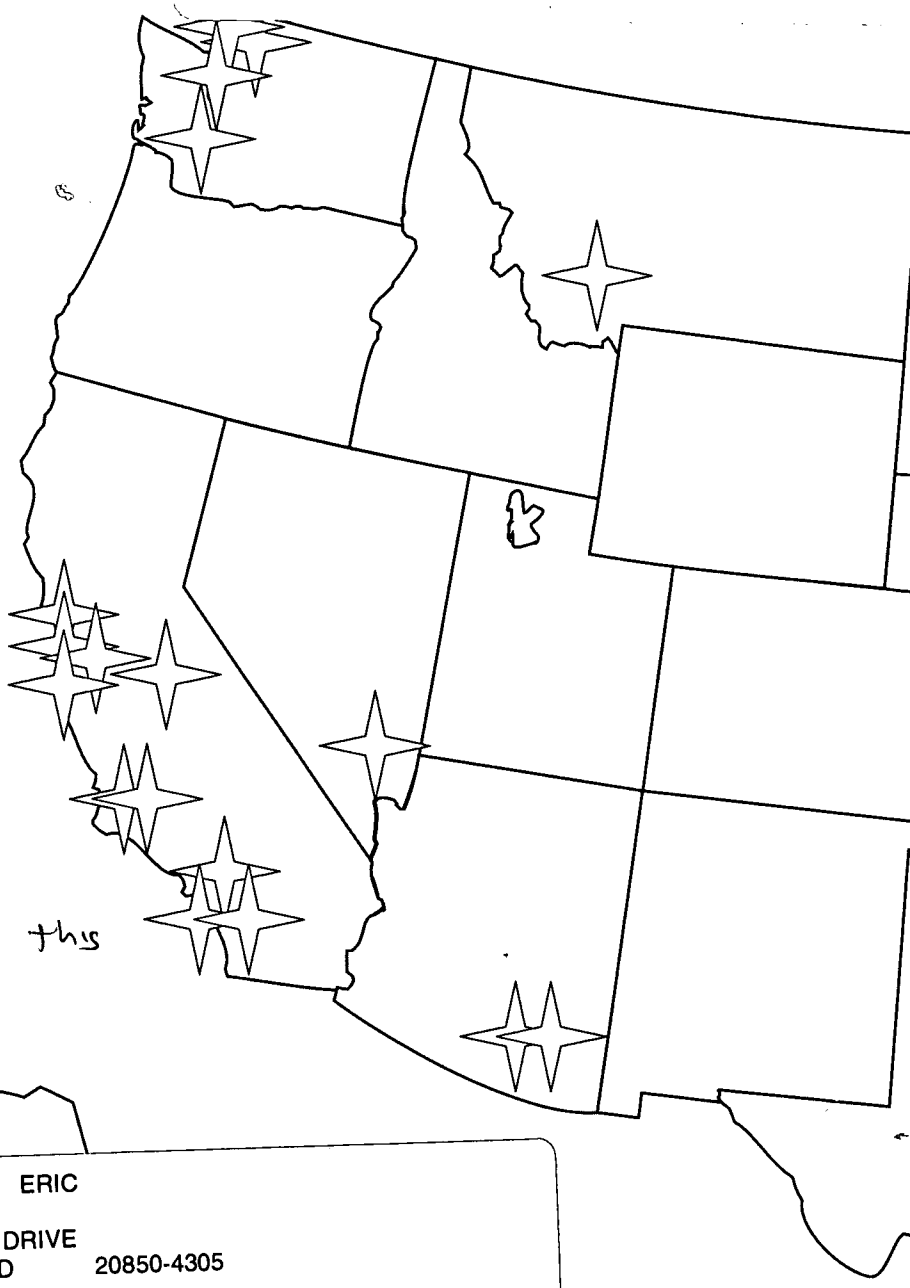

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